

## REMARKS

This communication is a full and timely response to the Office Action dated December 28, 2009. Claims 1-4, 6-10, and 14-18, 21 and 22 remain pending, where claims 5, 12, 13, and 20 were previously canceled. By this communication, claims 11 and 19 are canceled without prejudice or disclaimer to the underlying subject matter, claims 1, 4, 6-10, and 14-18 are amended, and claims 21 and 22 are added.

In numbered paragraph 1 on page 2 of the Office Action, the Examiner makes a request for information regarding the publication date of the 3M Radiant Mirror Film product sheet provided in an Information Disclosure Statement filed on August 13, 2007.

Applicant submits that while the product sheets are marked as "Experimental", it appears that they were available as prototypes and produced for market evaluation purposes. The exact date of publication or availability of the 3M Radiant Mirror Film is not known by the Applicant, however, this product and data sheet were available at the time of Applicant's invention.

In numbered paragraph 3 on page 2 of the Office action, claims 1, 4, 6-11, and 14-20 are rejected under 35 U.S.C. §112, second paragraph for alleged indefiniteness. Applicant respectfully traverses this rejection.

The Examiner alleges that claim 1 is indefinite due to its recitation of "high and low refractive index non-metallic layers", "emissive characteristics", "low absorbency characteristics", and "high transmissive characteristics".

Applicant has amended claim 1, to change the term "high and low refractive index" to "higher and lower refractive index layers arranged to filter the radiation based on interference effects between different components of the radiation

produced by reflection at the boundaries between the layers". As is known by one of ordinary skill, the term refractive index relates to the measure of how much the velocity of a wave is reduced inside a medium. The difference in refractive index between two materials can be evidenced by the reflection or diffraction of the wave propagating from one medium to the other. Thus, the high or low level of the refractive index of one medium is relative to the level of the refractive index of another medium in from which or to which a wave propagates. Moreover, in the disclosure Applicants describe the high and low refractive index layers as follows:

Light reflected within the high index layers will not suffer any phase shift due to reflection, whereas light reflected within the low index layers will undergo a 180 degree phase shift as a result of reflection. See pg. 5, ll. 23-26.

In Section 2173.02, the Manual of Patent Examination Procedure provides that the essential inquiry pertaining to this requirement is whether the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity. Definiteness of claim language must be analyzed, not in a vacuum, but in light of:

- (A) The content of the particular application disclosure;
- (B) The teachings of the prior art; and
- (C) The claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made.

In reviewing a claim for compliance with 35 U.S.C. 112, second paragraph, the examiner must consider the claim as a whole to determine whether the claim apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 U.S.C. 112, second paragraph, by providing clear warning to

others as to what constitutes infringement of the patent. See, e.g., *Solomon v. Kimberly-Clark Corp.*, 216 F.3d 1372, 1379, 55 USPQ2d 1279, 1283 (Fed. Cir. 2000). See also *In re Larsen*, No. 01-1092 (Fed. Cir. May 9, 2001) (unpublished). MPEP §2173.02.

Breadth of a claim is not to be equated with indefiniteness. *In re Miller*, 441 F.2d 689, 169 USPQ 597 (CCPA 1971). If the scope of the subject matter embraced by the claims is clear, and if applicants have not otherwise indicated that they intend the invention to be of a scope different from that defined in the claims, then the claims comply with 35 U.S.C. 112, second paragraph. See MPEP §2173.04.

Therefore, based on Applicant's claim language, the support provided in the disclosure, and accepted practice under 35 U.S.C. §112, second paragraph, Applicant believes that the term "higher and lower refractive indices" recited in claim 1 is not indefinite because it defines the scope of the claimed embodiment with clarity and precision.

Similarly, the terms absorbency, emissive, and transmissive are all characteristics of material layers that are known in the art. Thus, while the modifying terms high and low, where applicable in the claims, may be broad, they are not indefinite. Given that a reading of the claim would apprise a person of ordinary skill in the ability to interpret the metes and bounds of the claim in order to avoid infringement, Applicant respectfully submits that claim 1 is definite. Withdrawal of this rejection, therefore, is respectfully requested.

Relative to claims 7, 8, and 14-20, Applicant has addressed the Examiner's concerns through the enclosed claim amendment. Withdrawal of this rejection is thereby, deemed appropriate.

In numbered paragraph 8 on page 4 of the Office Action, claims 1, 4, 6, 9, and 10 stand rejected under 35 U.S.C. §103(a) for alleged unpatentability over *Jonza et al.* (US 5882774) in view of *3M<sup>TM</sup> Radiant Mirror Film VM2000F1A6 Product Sheet* ("3M Product Sheet"). Applicant respectfully traverses this rejection.

As shown in Figs. 1-5, Applicants describe and exemplary antenna having an active face on which a thermal control film is disposed. The thermal control film has a polymeric multi-layer structure that includes a set of interference filters. The layer structure of the thermal control film includes a stack of alternating high and low refractive index dielectric films. The thermal control film has a low absorbency of solar radiation, and a high absorbency and emissive characteristic in the infrared wavelength range 2.5 $\mu$ m to 50 $\mu$ m, which corresponds to the spectrum of heat generated by the high frequency circuits of the antenna array. The film also exhibits a high transparency to the microwave frequencies, typically 1 to 30 GHz.

Independent claim 1 broadly encompasses the foregoing features by reciting the following:

An antenna comprising:  
an active face, at least one radiating element for transmitting radio frequency (RF) signals via the active face, and a thermal control film covering the active face, the metal free thermal control film comprising:  
a multi-layer interference filter having alternating higher and lower refractive index layers arranged to filter the radiation based on interference effects between different components of the radiation produced by reflection at the boundaries between the layers, said control film exhibiting preselected high absorbency and emissive characteristics in the infrared wavelength range 2.5 $\mu$ m to 50 $\mu$ m, low absorbency characteristics in the solar spectrum range 200-2500nm and high transmissive characteristics in the microwave frequency spectrum 1 to 30GHz, wherein the thermal control film allows heat dissipated in the antenna to be radiated into space via the active face.

The combination of *Jonza* and *the 3M Product Sheet* fails to disclose or suggest every feature recited in independent claim 1.

*Jonza* discloses an optical film having a multilayered polymeric sheet with alternating layers of polyethylene naphthalate and a polymer that is a reflective polarizer or mirror. The multilayer construction as shown in Fig. 1b includes alternate low and high index thick films having no tuned wavelengths or bandwidth constraints. The preferred multilayer stack ensures that wavelengths that would be most strongly absorbed by the stack are the first wavelengths that would be most strongly absorbed by the stack.

The Examiner acknowledges that *Jonza* fails to disclose or suggest the characteristics of Applicant's claimed multilayer film and relies on the *3M Product Sheet* in an effort to remedy this deficiency.

The *3M Product Sheet* provides the specification and properties an optical film. The optical film disclosed in the *3M Product Sheet* could not be used in a spacecraft application because it does not embody the proper spectral characteristics. While this film can reflect visible light, it transmits a "tail" of infrared radiation. One of ordinary skill would recognize that these properties which are inconsistent with Applicant's claimed characteristics based on the specifications provided in the *3M Product Sheet*.

Applicant submits, however, that neither *Jonza* nor *the 3M Product Sheet* discloses or suggests an antenna having an active face nor a film covering the active face as recited in claim 1. Rather, both references are merely directed to the structure of an optical film.

Moreover, *Jonza* and *the 3M Product Sheet* disclose that the thermal control film allows heat dissipated in the antenna to be radiated into space via the active face. This property of the film results from the characteristics of the film--high

absorbency and emissive characteristics, low absorbency characteristics, and high transmissive characteristics in the noted ranges--which are neither disclosed nor suggested in the cited references.

In summary, *Jonza* and *the 3M Product Sheet* when applied individually or collectively fail to disclose or suggest every feature and/or the combination of features recited in claim 1. For this reason, a prima facie case of obviousness has not been established and withdrawal of this rejection is respectfully requested.

In numbered paragraphs 11 and 15, claims 7 and 8 are rejected under 35 U.S.C. §103(a) for alleged unpatentability over *Jonza* in view of *the 3M Product Sheet* and further in view of *Iacovangelo et al.* (US 6587263); and claim 11 is rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over *Jonza* in view of *the 3M Product Sheet* in view of *Lepore et al.* (US 5373305). Applicant respectfully traverses these rejections.

Claims 7, 8, and 11 variously depend from claim 1. By virtue of this dependency, these claims are distinguishable over the applied combination of references because *Lepore* and *Iacovangelo* fail to remedy the deficiencies of *Jonza* and *the 3M Product Sheet* identified above. Moreover, the subject claims are deemed to be further distinguishable over the applied references due to the respective additional features recited therein.

For example, the Examiner alleges that *Lepore* remedies the deficiencies of *Jonza* and *the 3M Product Sheet* as it related to a spacecraft antenna having an active face. Applicant disagrees.

As discussed in Applicant's previous response, *Lepore* discloses an RF transparent thermal insulation blanket for an antenna reflector. The blanket uses an

outer coating of germanium to reflect some of the solar spectrum. This outer coating is particularly important to the design because it "controls the thermo-optical properties (i.e., both decreasing solar absorptance and maintaining emittance) without undesirably increasing RF insertion loss." See Lepore, col. 5, ll. 64.

*Lepore* does not employ a multi-layer interference filter having alternating high and low refractive index layers arranged to filter the radiation based on interference effects between different components of the radiation produced by reflection at the boundaries between the layers, as recited in claim 1. Moreover, *Lepore* does not disclose or suggest a film that can be applied to an antenna comprising an active face. Rather, *Lepore* discloses a film that can be applied to a reflector such as a parabolic dish to minimize the amount of radiation from the sun reflected onto the antenna feed structure and to avoid mechanical distortion or warping of the reflector. The film of *Lepore* would trap heat below the film leading to over-heating of the antenna if the film was applied to an active face, as required by claim 1.

This characteristic of *Lepore* is important because active antennas, i.e., antennas comprising many radiating elements driven by their own amplifiers, will naturally radiate heat as well as well as radiofrequency (RF) signals. None of the films disclosed in the cited art disclose properties that embody the combined properties of transmitting RF energy, along with the waste heat, while minimizing the incident heat from the sun.

In summary, *Jonza*, *the 3M Product Sheet*, *Lepore*, and *Iacovangelo* when applied individually or collectively fail to disclose or suggest every feature recited in the claims. For at least this reason, the applied references fail to establish a *prima*

*facie* case of obviousness. Withdrawal of these rejections, therefore, is respectfully requested.

### **Conclusion**

Based on the foregoing amendments and remarks, Applicant respectfully submits that claims 1, 4, 6-11, 14-18, 21 and 22 are allowable and this application is in condition for allowance. In the event any unresolved issues remain, the Examiner is encouraged to contact the undersigned.

Respectfully submitted,

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